



TAKING STOCK IN YOUR FUTURE:

intermediate

A PROFESSIONAL DEVELOPMENT PROGRAM
FOR INTERMEDIATE GRADE TEACHERS



Investor
Education Fund



Taking Stock in Your Future – Intermediate

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For additional copies of the *Taking Stock in Your Future Intermediate Guide* e-mail us at fundmail@investorED.ca or visit our Web site: www.investorED.ca

Project Team:

Eleanor Adam,
Continuing Education,
OISE/UT

Lara Cartmale,
Continuing Education,
OISE/UT

Reg Cartmale,
Education Consultant

Judith David-Wilson,
Iroquois Ridge High School,
Halton District School Board

Laura Gollino,
Continuing Education,
OISE/UT

Brendan Kelly,
Professor Emeritus, OISE/UT

Doug McDougall,
Professor, OISE/UT

Joanne Quinn,
Continuing Education,
OISE/UT

Jan Scully,
Instructor, OISE/UT

Authors:

Eleanor Adam

Lara Cartmale

Laura Gollino

Brendan Kelly
(Senior Author)

Doug McDougall

Jan Scully

Advisory Team:

Christine Allum,
Investor Education Fund

Eleanor Fritz,
Toronto Stock Exchange

Shonna Froebel,
Toronto Stock Exchange

Shauna Gray,
Toronto Stock Exchange

Elissa Kaiser,
Investor Education Fund

Darrell Pinto,
Toronto Stock Exchange

Nancy Stow,
Investor Education Fund

Introduction and Acknowledgements

Building on the success of *Taking Stock in Your Future Senior Program*, introduced in high schools in 2000, this document offers unique, leading-edge teaching and assessment resources for the intermediate level student. *Taking Stock in Your Future Intermediate Program* is a professional development program to help teachers of grades 7 and 8 introduce their students to money management and financial planning in a mathematics context.

The program was developed by the Toronto Stock Exchange and the Investor Education Fund in collaboration with the project team in Continuing Education at the Ontario Institute for Studies in Education of the University of Toronto (OISE/UT). A three-day institute and a resource guide were designed; this is the final version of that resource guide. Incorporating input from participants of the institute and from educators who field-tested the *Guide* in their classrooms in the 2001/2002 school year, this document has been enhanced to meet the needs identified by educators across the country.

The field-testing resulted in the student samples incorporated throughout the *Guide* in the “*What You Might Expect to See*” sections. We are deeply indebted to the following teachers and their students for these samples, as well as for insightful recommendations for the *Guide*:

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Iroquois Ridge High School, Ontario

Kevin Haggith,
Coronation Public School, Ontario

Teresa Hehn,
Sir James Douglas, British Columbia

Simon Houzer,
Westwood Public School, Ontario

Faith Howie,
Doon Public School, Ontario

Natalie Jalette,
Bishop Smith Catholic High School,
Ontario

Monique Kaptein,
Margaret Avenue School, Ontario

Keith Murray,
Wawanesa School, Manitoba

Enzo Tignanelli,
St. Luke Catholic High School,
Ontario

Contents



Introduction & Acknowledgements	ii
Setting the Context – Curriculum Connections and Benefits for Students	1
Mathematical Skills and Concepts: Grade 7	3
Mathematical Skills and Concepts: Grade 8	5
Mathematical Skills and Concepts: Grade 9	7
Planning an Effective Mathematics Program	9
Planning Process – Designing Down Model	9
Components	10
How to use this Guide	13
The Activities	14
Additional Resources	14
Portfolio Checklist	15
Teaching Strategies	16
Problem Solving	17
Co-operative Group Learning	18
Co-operative Group Learning Strategies	19
Assessment Tools	23

Module I: Understanding Money and Money Management

Prerequisite Skills	25
Activity 1 – Introducing Personal Finance	26
Introducing Personal Finance	28
What is Wealth?	29
The Evolution of Money	30
Exercise Solutions	34
What You Might Expect to See	35
Activity 2 – Earning Money	42
Wealth Builder	44
Earning Money	45
Investigation: Mass Mailing for Music Madness	47
Choosing a Payment Option	48
Internet Investigation	49
What's the Minimum Hourly Wage in Your Province – Worksheet	50
Country Comparisons – Worksheet	51
Job Search – Worksheet	52
Exercise Solutions	53
What You Might Expect to See	55
Activity 3 – Contracting Your Services	58
Contracting Your Services	60
Internet Investigation	61
What's the Job Market for Babysitters in Your Neighbourhood – Worksheet	62
Investigation: Melissa Contracts to Work for Pennies	63
Exercise Solutions	65
What You Might Expect to See	67
Activity 4 – Other Forms of Money	70
Exploring Cheques	72
Investigation: Exploring Debit & Credit Cards	74
Exercise Solutions	76

Activity 5 – Saving and Budgeting	78
Being Responsible	80
Saving and Budgeting	81
Distinguishing between Needs & Wants	82
Saving Money	84
Planning Your Savings	85
Exercise Solutions	86
What You Might Expect to See	87
Activity 6 – Costs: Sales, Discounts & Taxes	94
Costs: Sales & Discounts	96
Investigation: Additional Costs: Taxes & Tips	97
Exercise Solutions	99
<hr/>	
Module II: Ways of Investing in Your Future	
Prerequisite Skills	101
Activity 7 – Growing Your Savings	102
Growing Your Savings	104
The Value of Interest	106
Internet Investigation	106
Comparing Savings, GICs, and T-bills – Worksheet	107
Exercise Solutions	108
Activity 8 – Canadian Entrepreneurs	110
Canadian Entrepreneurs	112
Working With a Million	114
Internet Investigation	115
Exercise Solutions	116
What You Might Expect to See	118
Activity 9 – Investing: Mickey Mantle to Picasso	126
Investing: Sports Cards	128
Percent Growth – Worksheet	129
Investing in Art	130
Investigation: How Do You Calculate Growth Rate?	131
Internet Investigation	132
Exercise Solutions	133

Activity 10 – Investing in Companies	135
Dream Ride	138
Investing in Companies	139
How do Stock Markets Work?	140
How do Stock Markets Work? – The Process	141
Investigation: How do You Read a Stock Page?	142
Newspaper Investigation	143
Exercise Solutions	144

Module III: Stock Markets & Portfolios

Prerequisite Skills	147
Activity 11 – Why Buy Stocks?	148
Name That Term – Worksheet	150
Why Buy Stocks – Dividends & Capital Gains	152
Calculating Yield and Return on Investment	153
Investigation: Rank the Companies as Investments	155
Internet Investigation	156
Exercise Solutions	157
Activity 12 – The Law of Supply and Demand	159
The Law of Supply and Demand	161
What Determines Price?	162
Investigation: Using <i>P/E</i> Ratios to Assess Demand	163
Exercise Solutions	165
Activity 13 – Selecting Investments for Your Portfolio	169
Selecting Investments for Your Portfolio	172
Investor Profile Self Test – Worksheet	173
Investment Risk Categories	174
Investigation: Choosing Stocks from the Toronto Stock Exchange	175
Internet Investigation 1	175
Internet Investigation 2	177
Exercise Solutions	178

Activity 14 – Monitoring Your Investment Portfolio	179
Monitoring Your Investment Portfolio	181
Worksheet	182
Investigation: Creating a Spreadsheet for Your Portfolio	184
Exercise Solutions	186
Activity 15 – Assessing Your Portfolio	187
Assessing Your Portfolio	189
Reporting on Your Investment Portfolio	191
Your Final Project	192
Exercise Solutions	193
What You Might Expect to See	194
Feedback Form – Celebrate Taking Stock in Your Future	200
List of Resources	201
Print for Teachers	201
Web Sites for Teachers	202
Print for Students	204
Video for Students	204
Web Sites for Students	205
Software for Students and Teachers	206
Glossary of Financial Terms	207
Summary of Formulas	210



Setting the Context – Curriculum Connections and Benefits for Students

Curricula in the senior elementary grades recommend that instruction be embedded in real-life situations and skills be developed in ways that enhance the student's ability to be successful in an increasingly competitive world. Curricula in senior grades build on these same fundamental principles as the elementary program.

To support these curriculum goals, *Taking Stock In Your Future Intermediate* explores financial literacy as the overarching theme. It enhances and integrates language with mathematics content. Personal money management forms the basis for financial literacy; it is one of the key practical survival skills that we can teach our students. Introducing students to the effective management of personal finances provides them a solid foundation for their futures. Within this framework of financial literacy, the *Intermediate Guide* reflects the growing need for students to expand their mathematical and technological skills within meaningful contexts.

In this information age, financial literacy is an indispensable skill in achieving security and realizing our dreams.

Your Notes

Taking Stock in Your Future Intermediate is designed to empower teachers with the essential tools for engaging the learner through interactive environments. Activities are designed to help you teach students to

- Solve problems
- Communicate effectively
- Reason and think logically
- Interpret and refine the idea process
- Apply ideas in creative ways
- Gain confidence and manage uncertainty
- Form judgments about the reasonableness of results
- Understand there are many ways to arrive at a solution

Mathematical Skills and Concepts

Activities in the *Taking Stock in Your Future Intermediate Guide* have been fully integrated with mathematics curricula across Canada. Specifically, the following seven mathematical processes are included in each course and also connect with the knowledge and skills that student acquire:

- 1 problem solving
- 2 reasoning and proving
- 3 reflecting
- 4 selecting tools and computational strategies
- 5 connecting
- 6 representing
- 7 communicating

The organization of the *Guide* by using separate ‘teacher’ and ‘student’ pages supports an emphasis on process by identifying strategies and activities relevant to the acquisition of knowledge and skills.

The following pages will provide you with some examples of the mathematical concepts and skills that are explored in each Activity by strand for grades 7, 8 and 9.

Number Sense and Numeration

Measurement

Geometry and Spatial Sense

Patterning and Algebra

Data Management and Probability

Visit our website, www.investorED.ca for more curriculum corrections.

Mathematical Skills and Concepts: Grade 7

Specific Expectations

Number Sense and Numeration		Activities														
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	represent and order integers using a variety of tools (e.g. two-colour counters, virtual manipulatives, number lines)	•														
2	represent, compare and order decimals to hundredths and fractions, using a variety of tools							•	•		•					
3	use a variety of mental strategies to solve problems involving the addition and subtraction of fractions and decimals		•				•		•	•		•	•	•		
4	solve problems involving the multiplication and division of decimal numbers to thousandths by one-digit whole numbers, using a variety of tools								•	•						
5	solve multi-step problems arising from real-life concepts and involving whole numbers and decimals, using a variety of tools		•	•		•	•	•		•			•		•	
6	use estimation when problem solving involving operations with whole numbers, decimals and percents to help judge the reasonableness of a solution						•									
7	evaluate expressions that involve whole number and decimals including expressions that contain brackets, using order of operations							•		•	•				•	
8	add and subtract integers, using a variety of tools (e.g. two-colour counters, virtual manipulatives, number lines)	•	•	•								•	•	•		
9	determine through investigation, the relationships among fractions, decimals, percents and ratios			•			•									
10	solve problems involving the calculation of unit rates		•													

Measurement		Activities														
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	estimate and calculate the area of composite two-dimensional shapes by decomposing into shapes with known area relationships			•												

Patterning and Algebra		Activities														
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	represent linear growing patterns, using a variety of tools and strategies			•				•	•							
2	translate phrases describing simple mathematical relationships into algebraic expressions		•			•	•	•		•		•	•	•		
3	evaluate algebraic expressions by substituting numbers for the variable					•		•			•	•	•		•	
4	solve linear equations of the form $ax=c$ or $c=ax$ and $ax+b=c$ or variations such as $b+ax=c$ and $c=bx+a$ by modelling with concrete materials, by inspection, or by guess and check, with and without the aid of a calculator		•													

Data Management and Probability		Activities														
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	collect and organize categorical, discrete or continuous primary data and secondary data (e.g. electronic data from web sites such as E-Stat or Census at Schools) and display the data in charts, tables and graphs (including relative frequency tables and circle graphs) that have appropriate titles, labels (e.g. appropriate units marked on the axes) and scales (e.g. with appropriate increments) that suit the range and distribution of the data, using a variety of tools (e.g. graph paper, spreadsheets, dynamic statistical software)		•	•				•				•		•	•	
2	select an appropriate type of graph to represent a set of data, graph the data using technology, and justify the choice of graph (i.e. from types of graphs already studied)					•				•				•		•
3	identify and describe trends, based on the distribution of the data presented in tables and graphs, using informal language						•	•	•							•
4	make inferences and convincing arguments that are based on the analysis of charts, tables and graphs			•		•	•				•	•	•	•	•	•

Mathematical Skills and Concepts: Grade 8

Specific Expectations

Number Sense and Numeration		Activities														
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	express repeated multiplication using exponential notation			•					•	•						
2	represent whole numbers in expanded form using powers of ten									•						
3	translate between equivalent forms of a number (i.e. decimals, fractions, percents)							•								
4	solve multi-step problems arising from real life contexts and involving whole numbers and decimals, using a variety of tools (e.g. graphs, calculators) and strategies (e.g. estimation, algorithms)		•				•	•		•	•		•		•	•
5	solve problems involving percents expressed to one decimal place (e.g. 12.5% and whole-number percents greater than 100 (e.g. 115%))				•		•			•						
6	use estimation when solving problems involving operations with whole numbers, decimals, percents, integers and fractions to help judge the reasonableness of a solution						•									
7	solve problems involving addition, subtraction, multiplication and division with simple fractions		•				•				•					
8	solve problems involving operations with integers, using a variety of tools (e.g. two color counters, virtual manipulatives, number lines)	•	•	•	•	•	•	•		•	•	•		•	•	•
9	evaluate expressions that involve integers, including expressions that contain brackets and exponents, using order of operations									•	•				•	
10	solve problems involving percent that arise from real life contexts				•		•	•		•	•				•	•
11	solve problems involving rates		•													

Measurement		Activities														
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	measure the circumference, radius and diameter of circular objects, using concrete materials			•												

Patterning and Algebra		Activities														
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	represent linear patterns graphically (i.e. make a table of values that shows the term number and the term, and plot the coordinates on a graph) using a variety of tools					•				•						
2	model linear relationships using tables of values, graphs and equations through investigation using a variety of tools					•		•		•	•	•	•	•		

Data Management and Probability		Activities														
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	collect and organize categorical, discrete or continuous primary data and secondary data (e.g. electronic data from websites such as E-Stat or Census at Schools) and display the data in charts, tables and graphs (including relative frequency tables and circle graphs) that have appropriate titles, labels (e.g. appropriate units marked on the axes) and scales (e.g. with appropriate increments) that suit the range and distribution of the data, using a variety of tools		•	•				•				•		•	•	
2	select an appropriate type of graph to represent a set of data, graph the data using technology, and justify the choice of graph (ie from types of graphs already studied)					•	•			•					•	•
3	identify and describe trends, based on the distribution of the rate of change of data from tables and graphs, using informal language					•		•				•		•		•
4	make inferences and convincing arguments that are based on the analysis of charts, tables and graphs	•	•	•	•	•	•	•		•	•	•	•	•	•	•

Mathematical Skills and Concepts: Grade 9 Principles (Academic)

Overall Expectations

Number Sense and Algebra		Activities														
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	demonstrate an understanding of the exponent rules of multiplication and division, and apply them to simplify expressions			•				•	•	•	•					
2	manipulate numerical and polynomial expressions, and solve first-degree equations	•	•		•		•	•		•	•		•	•	•	•

Linear Relations		Activities														
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	apply data-management techniques to investigate relationships between two variables	•	•	•	•	•	•			•	•	•	•	•	•	•
2	demonstrate an understanding of the characteristics of a linear relation		•		•	•	•	•		•					•	•
3	connect various representations of a linear relation		•		•	•										

Analytic Geometry		Activities														
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	determine the relationship between the form of an equation and the shape of its graph with respect to linearity and non-linearity		•					•		•						
2	determine, through investigation, the properties of the slope and the y-intercept of a linear relation		•		•											
3	solve problems involving linear relations		•			•										

Measurement and Geometry		Activities														
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	solve problems involving measurements of two-dimensional shapes and the surface areas and volumes of three-dimensional figures			•												

Mathematical Skills and Concepts: Grade 9 Foundations (Applied)
Overall Expectations

Number Sense and Algebra		Activities														
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	solve problems involving proportional reasoning		•		•		•	•		•	•		•	•	•	•
2	simplify numerical and polynomial expressions in one variable, and solve simple first-degree equations	•	•					•		•	•			•		

Linear Relations		Activities														
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	apply data-management techniques to investigate relationships between two variables	•	•	•	•	•	•			•	•	•	•	•	•	•
2	determine the characteristics of linear relations		•		•	•	•	•		•					•	•
3	demonstrate an understanding of constant rate of change and its connection to linear relations		•		•											
4	connect various representations of a linear relation, and solve problems using the representations		•			•										

Measurement and Geometry		Activities														
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	solve problems involving the measurements of two-dimensional shapes and the volumes of three-dimensional figures			•												

Planning an Effective Mathematics Program

Taking Stock in Your Future Intermediate has been designed to reflect the components of an effective mathematics program. Current mathematics curricula require increased skills in processing information, managing authentic data, problem solving, and the appropriate use of technology. To be effective in this context, a mathematics program must have both increased accountability and innovative methodologies for instruction and assessment. To achieve these requirements, this *Guide* uses a *Designing Down Model* for planning. A template of this model is provided here for teachers as an effective process and reflective tool when designing other units of study.

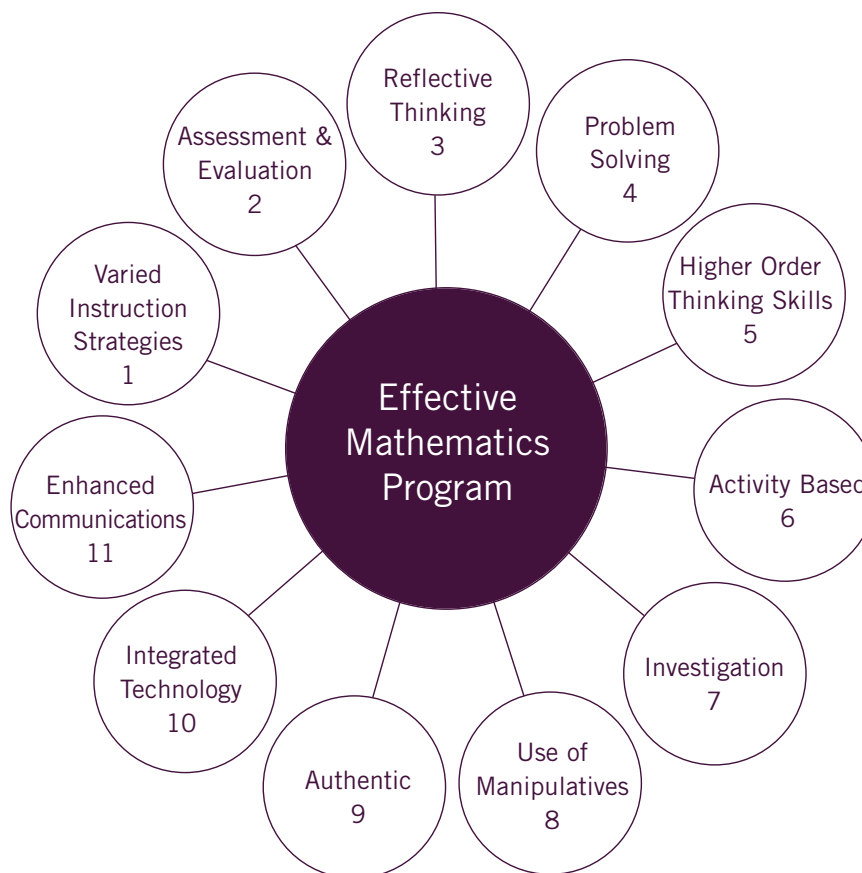
The Planning Process — Designing Down Model

Components	Relevant Questions
Establish Expectation – Diagnostic Assessment	<ol style="list-style-type: none"> 1 What mathematics expectations can my students already demonstrate to the standard? 2 What expectations do my students need to consolidate to reach the standard? 3 What new knowledge and skills are to be learned?
Determine the Indicators for Successful Learning	<ol style="list-style-type: none"> 4 What will students know and be able to do? 5 How will I know they have truly learned it? 6 What assessment strategies will I use? 7 How will I support a variety of learners?
Provide Appropriate Instruction and Student Activities	<ol style="list-style-type: none"> 8 In what components of the <i>Guide</i> will they be able to demonstrate the expectations? 9 In what Activity of the <i>Guide</i> will I teach the expectations? 10 What exercise and investigations will I teach, provide practice, and assess the students' ability to demonstrate these expectations to the standard?
Communicate Student Achievement	<ol style="list-style-type: none"> 11 What format will my evaluation take? 12 How will I indicate growth towards the standard? 13 How will I involve students and parents? 14 How do I readily determine the strengths, weaknesses and next steps for each student? 15 How does this information support future planning, assessment and learning?

Your Notes

Components

In designing an effective mathematics program, several key components can be identified. The diagram below highlights the foundations required in an effective mathematics program.

**1 A Variety of Instructional Strategies**

These strategies help foster students' abilities to solve problems, communicate and reason mathematically, and apply new knowledge. They may also lead students to develop self-respect, a respect for others through working collaboratively with peers, and a motivation to learn.

2 Use of a Variety of Appropriate Assessment and Evaluation Strategies

The action / demonstration verbs at the beginning of the specific expectations indicate to the teacher the type of assessment strategy that might be appropriate. For example, "explains and describes" might lend itself to a journal entry or "constructs and makes" could be assessed by a performance task, while "recognizes and identifies" may be best assessed through observation.

Your Notes

3 Increased Metacognitive and Reflective Practices

Students who reflect upon their learning and practices become more aware of how they think as a learner and how to improve their thinking / learning of mathematical ideas and concepts.

4 Problem Solving as a Focus for Instruction

As much as possible, problem solving should be woven into every learning experience. New skills should be introduced through a problem situation that is appropriate and motivating to the students. The new skills arise from a need to solve the problem. Students are encouraged to identify, recognize, and communicate about authentic problem situations.

5 Increased Use of Reasoning Skills as well as Higher Order Thinking Skills

Students should not only be asked to give a response to a question but be expected to provide reasons for the response. A key question is, “What made you think of doing the problem that way?” Students should be expected to create problems and solve problems.

6 Increased Student Involvement Through Activity-Based Programs

Students learn best by being involved actively in their learning. The exercises developed should be clearly focused on what the student will learn through practice and should represent the best way to learn this new skill or concept. *“I hear and I forget, I do and I remember.”*

7 Students Involved in Exploring and Investigating New Concepts and Skills

When students construct their own knowledge through the skilful guidance of the teacher, they remember more often what has been learned. Exploring ideas helps them take on the role of a mathematician – a creator of valued ideas. When these ideas are expressed and valued by peers, the students gain confidence, self esteem, respect from others, as well as a motivation to learn and share more.

8 Use of Manipulatives, Visuals, and Other Hands-On Materials to Develop New Concepts and Skills

Students make sense of new ideas when they can touch, move, and reshape concrete materials. They are trying to make sense of these ideas by internalizing their workings in a visual sense. The images a student creates can help make the connection to the abstract workings of the same idea. In fact, when the learner forgets the abstraction, the visual image comes into play and often results in positive response.

Your Notes

9 Authentic Connections

Students need to recognize that mathematics is neither a series of unrelated topics, nor a “stand alone” subject. By connecting with other subject areas such as the social sciences, students realize that mathematics is truly a subject that relates to most daily activities.

10 Effective, Efficient, and Proper Use of Technologies

Students should use calculators and computers in the proper context for explorations, investigations, and problem solving. Calculators should not be used to practice an operation or to find a quick answer to a computational problem. In addition to computer searches, students should be encouraged to visit libraries to conduct their research. Students should be taught when to use a calculator, mental computation, pencil and paper, or the computer in a problem-solving situation.

11 Increased Opportunities for Communication

Some students have difficulties “doing the math,” but can communicate very clearly by speaking or writing how to perform a certain task. Effective communications should occur not only in Language Arts, but also in Mathematics. Students should be encouraged to apply and extend their writing skills and speaking skills in Mathematics. They can keep mathematics journals and use prompts to write about mathematical concepts, process skills, and their attitudes about mathematics, and how they see themselves as mathematics students and mathematicians. They should be involved in describing, explaining, justifying, conjecturing, defending, etc., their ideas and solutions.

How to Use this Guide

Your Notes

Taking Stock in Your Future Intermediate is not limited to teaching mathematics as the main component of finance. It is an authentic resource to teach and assess knowledge and understanding, thinking and inquiry, application, and communication that may be used as a building block for discussion in other subject areas. For example, ethical issues such as “what does wealth mean?” can lead to a discussion of global standards of living in social science classes while financial terminology and report writing are suitable for language classes.

The *Guide* itself is organized into three modules. To encourage students to fully appreciate the scope of investing, it is recommended that all three modules be taught in sequence. Instructional strategies and lesson plans are included at the beginning of each Activity. Depending on the level of a class, it may be necessary to modify some of the exercises and explorations to include more basic or more challenging questions/concepts. Some instructors may choose to have a general discussion about Stock Markets and Portfolios (Module III) to gauge what students already know about this type of investing before beginning Module I.

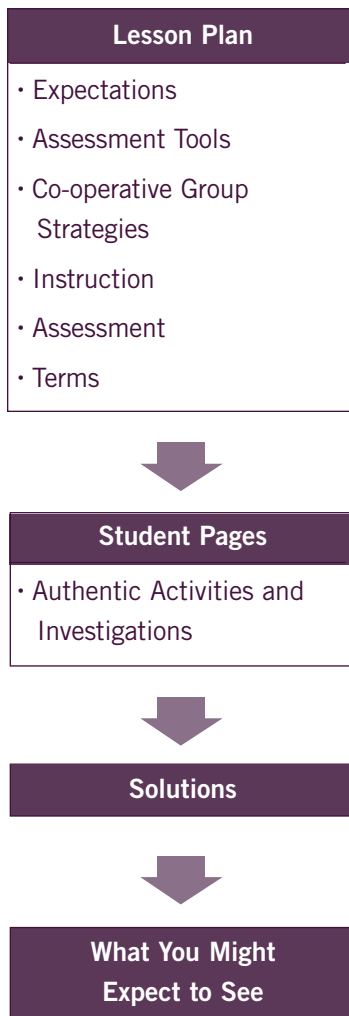
Module I Understanding Money and Money Management

This module introduces students to the basics of personal money management. From types of employment to budgeting and calculating tips, this module helps students understand the day to day importance of money and money management in their own lives. Students learn that they have control of their own financial future.

Module II Ways of Investing in Your Future

This module introduces the key to making money work – investing. Building on money management skills introduced in the first module, Module II leads students from interest and compound growth to reading stock information. In making the link between collecting and investing, students understand that there are many paths to wealth building, many of which they can begin to follow today.

Road Map of Activities



Module III Stock Markets and Portfolios

This module introduces students to the complexities of investing. In Module II, students learned that investing in companies can “grow money.” Now, students learn the mechanisms by which investments realize profits. From building an understanding of how prices are determined through analyzing stocks, students develop a firm understanding of investing that is invaluable in their financial futures.

The Activities

You will find that all Activities follow the same format shown in the road map on the left. Each has four sections: Lesson Plans, Student Pages, Solutions, and What You Might Expect to See.

The Lesson Plan section contains detailed instructional and assessment strategies, including optional extensions that may be used with advanced students. Summarized co-operative group strategies and helpful notes are presented in the sidebars of these pages.

Also included in the sidebars of the Lesson Plan are suggestions for further discussion and ideas for advanced classes under “Making Connections.”

Student pages may be photocopied and distributed to your students. Activities differ in length; note that students will monitor stocks and collect information for six weeks between Activities 14 and 15.

Student samples are found on the pages marked “What You Might Expect to See” and are annotated.

Additional Resources

In addition to the Activities, you will find several resources to help you plan and implement the *Taking Stock in Your Future Intermediate* program, including a List of Resources and a Glossary. Appended to the document, you will find a List of Formulas. To make the Internet Investigations as easy to use as possible, all URLs listed in Activities are accessible from the Investor Education Fund’s Web site. Please have students visit www.investorED.ca, Teachers’ Corner section. These Internet Investigations are essential for students’ final projects.

It is recommended that students keep both a journal and a portfolio specifically for their *Taking Stock in Your Future Intermediate* exercises. A checklist of the final products for the students’ portfolios is provided:

Portfolio Checklist

Should Include:	Activity
○ Financial Goals	5
○ Analyzing My Expenditures	
○ Investigation Exercise	
○ Investment Terms	7
○ Research a Canadian Entrepreneur	8
○ Stock Certificate	10
○ Newspaper Stock Analysis	
○ Investor Profile	13
○ Speculative and Moderate Risk Stocks	
○ Fixed Income and Cash Equivalent Investments	
○ Summary of Speculative Stocks	14
○ Summary of Moderate Risk Stocks	
○ My Own Spreadsheet	
○ Final Project	15

Your Notes

Teaching Strategies

Educational research has developed a compelling argument for a knowledge-building approach to instruction that reduces the role of the teacher as purveyor of information and enhances the teacher's role as facilitator of learning. Guided instruction and interactive learning allow students to discover concepts and ideas on their own. Concepts learned through this reflective process are usually internalized more deeply and retained with greater meaning than those passively received. Furthermore, when students report and discuss their discoveries with fellow students and the teacher, the learning is enhanced and consolidated.

With these fundamental benefits in mind, *Taking Stock in Your Future Intermediate* has been designed using an array of instructional strategies and provides the teacher with step-by-step instructions for implementation. The complete and innovative lesson plan is designed to maximize student achievement.

Specifically, this *Guide* employs the following categories of proven Instructional Strategies (based on Marzano, R., Pickering, D., & Pollock, J. 2001. *Classroom Instruction that Works, Association for Supervision & Curriculum Development*):

1 Identifying Similarities and Differences

Allows the student to compare, classify information, create metaphors by identifying patterns, and create analogies by recognizing relationships between concepts.

2 Summarizing and Note Taking

Helps students to synthesize information for deeper learning of a concept or skill.

3 Reinforcing Effort and Providing Recognition Through Introductory Activities

Encourages students to understand the link between effort and success in learning and uses recognition for specific accomplishments to motivate higher achievement.

4 Homework and Practice

Provides students with opportunities to deepen their understanding of information presented in the classroom.

5 Graphic Organizers

Supports student retention of concepts through the use of graphics, models, mental pictures, drawings and kinesthetic activity.

6 Co-operative Group Learning

Encourages heterogeneous groupings of students to work collaboratively on a specific task.

7 Setting Objectives and Providing Feedback

Helps students to establish long term and short term goals for learning and provides students with information on their strengths and areas for growth.

8 Generating and Testing Hypotheses

Engages students in the application of knowledge through the generation and explanation of hypotheses.

9 Questions, Cues and Advance Organizers

Activates students' prior knowledge through higher order thinking skills, cues to focus learning on important information, and visual organizers linking prior knowledge to new learning.

Problem Solving

Learning a systematic approach to problem solving will help students engage profitably in complex investigations. Students should be taught how to consider new problems by breaking problem solving down into steps. By following a Problem Solving Model the process can be made much easier. George Polya, one of the world's best problem solvers, developed a model to simplify problem solving. It has 4 stages that are adapted in the following model (*Mathpower 7, McGraw Hill, 1993 p. xi*). Included are some strategies that may help in the problem solving process.

Understand the Problem

- Read the problem to understand the language
- What information or facts am I given?
- Have I done a similar problem before?
- What am I asked to find?



Choose a Strategy

- What strategies do I know?
- Draw a diagram
- Look for a pattern
- Make a table
- Solve a simpler problem
- Use logical thinking



Your Notes

Your Notes

Carry Out the Plan

- Choose the method I will use to carry out the plan
- Give a final statement that gives the solution to the problem

**Look Back**

- Reread the question
- Check all calculations
- Is the answer reasonable?
- Does the answer agree with my estimate?

Note that mathematical strategies fall into the following basic categories:

- Compute or Simplify
- Use a Formula
- Draw a Diagram or Model
- Make a Table, Chart or List
- Estimate, Check and Revise
- Consider a Simpler Case
- Eliminate
- Look for Patterns

Co-operative Group Learning

Many of the teaching strategies in this document are based on co-operative group learning. It is recognized, however, that certain skills and concepts must be demonstrated and taught in traditional ways. *Taking Stock in Your Future Intermediate* reflects this balance among traditional modeling strategies and small group and individual exploration.

The five basic elements of co-operative group learning are (based on Johnson, D.W., Johnson, R.T. and Holubec, E.J. 1990. *Cooperative in the Classroom* (rev. ed.). Edina, MN: Interaction Book Company):

Individual Accountability

Each student within the group is responsible for learning and contributing to the successful completion of the assigned task.

Your Notes

Face to Face Interaction

Students should be organized in groups of two to six to encourage interaction and dialogue amongst group members. The students' attention is then focussed on the task.

Collaborative Skills

To work in groups effectively, students require social skills. Each co-operative group lesson should include a social skill such as encouraging others to contributing ideas or demonstrating respect for the opinions of others.

Processing

Following a group task, students need to reflect on the success of their academic and social tasks. This process allows groups to work together more effectively over time.

Positive Interdependence

Assigning group members roles such as Recorder, Encourager, Materials Manager or Reporter will help the group complete the task while establishing individual accountability. A clear and specific common goal, as well as the sharing of resources, contribute to positive interdependence.

You will find a list of co-operative group learning strategies suggested for each Activity in the Lesson Plan section of that Activity. The list that follows details a number of popular strategies; it is by no means an exhaustive list.

Co-operative Group Learning Strategies

Pairs Explore

Students work in pairs on an investigation / exploration. Students work together to recognize, describe, extend, and possibly create patterns. Pairs agree on results and prepare a report to share with other classmates.

Pairs Share

Usually following pairs explore, one pair shares and compares their results / strategies with another pair.

Class Share

Students share their thoughts or conclusions with the entire class. This should result in closure to an investigation.

Your Notes

Think-Pair-Share

Students work in pairs. Teacher poses a problem. Each student thinks individually about a response then shares ideas with their partner in an attempt to reach a solution to the problem.

Pairs Coach

In a pair, one student solves a problem while the other observes and coaches. Then, they switch roles.

Pairs Drill

Students work in pairs on a drill exercise. One member does the odd problems, the other the even problems. When problems are completed, students exchange papers and check each other's work.

Three-Step Interview

Students work in fours and separate into two pairs. Within each pair, one member interviews the other about ideas to solve a problem. Then, they reverse roles. The two pairs come together to share the results of the interviews and present their solution/strategies.

Corners

Students are randomly given a question or topic for which each must determine an answer or opinion. The students then proceed to the corner in the classroom that best reflects their answer or opinion. There are normally four or more corners. The students in each corner may then form a group for future investigations, seatwork, or discussions.

Inside-Outside Circle

Students stand in two concentric circles with the inside circle facing out and the outside circle facing in. Each student faces a partner and rotates after each question. Each student may or may not have a clipboard and paper to help them process the answers. This circle is used for review or practise of concepts:

- The teacher may ask the question for all the students to answer then share their results with the partner facing them.
- Different flash cards may be given to each student; the partners answer each of the questions then on cue rotate.

Co-op Co-op

Students work in small teams to investigate a topic for which they have a common interest. The team then shares the product with the class. The learning is seen as a process that flows out of the students' interests.

Your Notes

Numbered Heads

Students work in groups of four with each one being assigned a number from 1 to 4. The teacher poses a problem. The students work together to solve the problem. When the groups appear to be finished, the teacher calls out a number from 1 to 4 and asks that student from each group present the group's solution.

Roundtable

Students work in groups of four. Each group has only 1 pencil and 1 piece of paper. The teacher poses a problem. Each student writes 1 line of the solution then passes the paper and pencil to the next student. This continues until the problem is solved.

Brainstorm

Students work in groups of 3 or 4. Teacher poses a problem to solve. The group generates ideas without passing judgement. The group uses the ideas to generate a solution.

Jigsaw

Students begin in a home group and receive instructions. Each member is given a number. The groups dissolve and the students with the same numbers form expert groups. Each expert group explores and learns a different task. At the completion of the task, the expert groups dissolve and members return to their home groups. Each expert teaches the others about the task they explored.

Turn to Your Partner

Students work in pairs. The teacher asks students to turn to their partners and take turns in posing problems similar to those the teacher has just been explaining.

Co-operative Review

Students work in groups of four. Each group creates a set of problems and passes it to another group to solve. The solutions are then passed back to the original group for assessing.

Roam the Room

All the students roam throughout the room observing the products of other teams. At a given signal, all students return to their teams and report on the information they learned in their roaming.

Your Notes

Carousel Share

One person from each team stays seated by the team's presentation while the rest of the members rotate from presentation to presentation. The team representative presents the team's product with all the other teams as they rotate.

Gallery Tour

Teams' completed products are displayed around the room. Near each product is a piece of paper for other teams to ask questions or write comments. Each team discusses any questions and comments the other teams made about their product and revises the product if necessary.

For further details on co-operative group learning strategies the following resources are helpful:

Where Heart Meets Mind. Barrie, Carol, & Stevahn, L., 1991. Education Connections.

Cooperative Learning Resources for Teachers. Spencer Kagan, 1990.

Our Cooperative Classroom. Johnson, D.W., Johnson, Rr, Bartlett, J.K., Johnson, L.M., 1988. Interaction Book Company.

Assessment Tools

Your Notes

This *Guide* offers a diverse selection of assessment instruments appropriate to the learning opportunities that you find in the Activities. For each Activity, we have outlined appropriate assessment methods at the conclusion of the Lesson Plan. Each assessment and evaluation component of an Activity is designed to measure the student's ability to think, work co-operatively, communicate, observe, acquire, and apply knowledge.

It is important to note that meaningful assessment provides the teacher and the student with information to plan for adjustments for future learning. It is critical to student progress that assessment be ongoing and shared with the student.

The following assessment strategies are referred to throughout the *Guide*, and are based on Rolheiser, C., Bower, B. & Stevahn, C. 2000. *The Portfolio Organizer*.

Observation

Teachers may observe students to form impressions and make professional judgement about student growth in social skills, problem solving skills, learning skills and co-operative learning skills.

Journals

Components of successful journals:

- *Content Journals* involve the student writing or describing the meaning of a concept.
- *Process Journals* involve the student writing or describing the strategies used to arrive at a conclusion to a problem.
- *Procedural Journals* are similar to the above Process Journal, but involve extensive detail in logical, small steps. The students explain their process using words, numbers, diagrams, and symbols.
- *Attitude Journals* focus on how the students see themselves as problem solvers and mathematics students.

Portfolios

Portfolios are a collection of students' work that students gather over a period of time. They offer evidence of effort, improvement, process, and achievement. Portfolios represent a broad sampling of work and encourage the valuing of process as well as the product.

Your Notes

Performance Problems

A performance problem is based on students' demonstration of their ability to use the skills they have learned and the conceptual understanding they have developed in the context of a real-world application or complex problem. Performance problems:

- are a vehicle that can be used to assess the multiple dimensions of students' progress. Performance problems take 40 to 140 minutes. The rubric for a performance problem involves all the categories mentioned previously.
- provide opportunities for making connections between the strands of mathematics and other subject disciplines.
- allow for self-assessment on the part of the learner.
- promote the use of critical thinking, creative thinking, and a variety of problem solving strategies.
- provide a closer connection between what is taught, what is assessed, and real-life situations.

Performance Tasks

Performance tasks are alternate forms of assessment compared to the typical pencil and paper tasks. Performance tasks:

- are techniques of assessment that involve a student performing specific behaviours or skills in a short ten to fifteen minutes time span.
- have rubrics that involve one, at most two, categories from knowledge and understanding, problem solving, application, and communication.
- require active participation by the student.
- provide opportunities to assess group performances.
- permit the assessment of multiple performance criteria using a single task.